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ABSTRACT

A study designed to measure the impact of personal computer use on the productivity of managers was conducted in 1988 at a defense contractor's facility in Austin, Texas. A survey instrument of 20 questions designed to determine managers' perceptions of the impact of personal computers on their job performance was distributed to all 160 managers and directors of the company, and 91 questionnaires were returned (56.8% response rate). Analyses of the responses indicated that the personal computer was felt to be a valuable managerial tool, and that personal computers and their utilization rates exhibited a moderate amount of dependency upon them in certain areas. Recommendations based on these findings include encouraging the use of personal computers at all management levels, including non-engineering/non-technical areas; continuing the current incentive program to subsidize the purchase of personal computers by employees; and implementing an in-house training program in the use of computers. In addition, this study is proposed as a model for future research in this area, particularly for projects including more than one kind of company. (8 references) (CGD)

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THE IMPACT OF PERSONAL COMPUTERS ON MANAGEMENT ATTITUDE AND PRODUCTIVITY AT A LARGE DOMESTICALLY-BASED DEFENSE CONTRACTOR

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THE IMPACT OF PERSONAL COMPUTERS ON MANAGEMENT ATTITUDE AND PRODUCTIVITY AT A LARGE DOMESTICALLY-BASED DEFENSE CONTRACTOR

Do managers become more productive using personal computers? If not, why are so many business entities investing in this new technology? The lack of a clear-cut answer to this question is why this topic is a major point of discussion in business circles today.

In the past decade, the personal computer's effect on productivity has stimulated interest worldwide. Consequently, billions are being spent on personal computers. However, the impact that this equipment is having on performance is still largely being examined in very general qualitative terms. One difficulty in measuring or evaluating productivity in quantitative terms is due to the diversity of applications for which managers use personal computers. In order to focus on a single industry hoping to provide an accurate and comprehensive analysis of personal computer usage, the researchers determined that a specific defense contractor would be a representative corporation to test methodology designed to evaluate managerial productivity as it relates to personal computer usage.

The purpose of this study is to determine the perceptions of managers concerning the impact of personal computers upon their work performance at an Austin, Texas, Defense Contractor.

Note: A special thanks go to the following graduate students responsible for conducting a preliminary study of this topic. Curtis Olson, Mohamad F. Fakhreddine, Patrick D. Ferguson, Ron Josselet, Cecilio Martinez, Jr., R. Ferrell Shaffer, Dave Sprengelmeyer

IMPORTANCE OF THE PROBLEM

This research will expand the base of knowledge at the defense contractor's facility concerning the impact and effectiveness that personal computers are having on the work being performed by their managers. It will provide a resource upon which decision-makers can rely regarding future purchases of personal computers for managers of the company. The research will also provide a methodology which similar companies may utilize to measure the impact of personal computers upon managerial productivity.

MAJOR RESEARCH QUESTIONS

The objective of the research effort was to provide answers to the following management questions:

1. What percentage of managers actually use a personal Computer.
2. Do managers believe that they accomplish more tasks if they use a personal computer?
3. Do managers feel that the quality of their work is improved through the use of a personal computer?

To answer these management questions, specific research questions were developed to guide the researchers. These research

questions were:

1. How many managers have personal computers at work?
2. How many managers have personal computers at home?
3. How often do managers use their personal computers?
4. For what applications do managers use their personal computers?
5. Are managers in technical areas more likely to use personal computers than managers in other areas?
6. How have managers been trained to use personal computers?
7. Is age a factor in personal computer usage. (In other words, do "younger" workers use PC's more than "older" workers?)

LIMITATIONS OF THE STUDY

Internal Validity - Answer bias may be present due to the respondents inflating their abilities in PC use.

External Validity - A medium sized defense contractor may not be representative of other corporations that utilize PC's. This reduces the generalizability of the study to the survey results.

DEFINITIONS

A personal computer is defined as a single user, stand alone system which includes desktop and laptop personal computer

systems. A manager is defined as an employee who controls or directs a business program or project. (This survey utilized all personnel classified as managers and directors by the Industrial-Based Defense Contractor's personnel distribution list.)

REVIEW OF LITERATURE

A review of related literature revealed that there is a plethora of information concerning personal computer usage. Little prior research concerning measurement of managerial productivity with respect to personal computers was found. In 1982, 5.8 million units with an average price of $8,250 were sold. In 1992, these figures are expected to be 38 million units with an average price of $4,264. The trend is to move away from the monolithic, back-office mainframes to desktop computers. Today, desktop computers that sell for $5,000 are processing information at the same speed as IBM machines of thirteen years ago that sold for $3.5 million.[1]

Lewis and Verity pointed out that the old idea concerning processing power being expensive and a need for sharing between users is no longer true.[2] It now appears , that companies are finding it easier, quicker and less expensive to program and tailor PC's to meet the individual needs of users, rather than to do these same procedures on a mainframe. PC's are individualized, and the operators do not need to share them. This provides the user with more flexibility and

enhances the relationship between user and machine. This brings into question whether or not there is a payoff or benefit for distributing PC's to managers.

William Bowen, writing for Fortune [3] prefaces his article with this statement about computers. "U.S. business has spent hundreds of billions of dollars on them, but white collar productivity is no higher today than it was in the late sixties." (Bowen's statement is based upon a study by Stephen S. Roach of Morgan Stanley which concluded that technology has had little impact upon white collar productivity.) Bowen further concluded that the slow/down in computer and telecommunications spending which occurred in the middle of this decade was due to "a growing dissatisfaction with high tech's productivity payback." But, as illustrated by Lewis and Verity in the previous article, it may not be appropriate at this time to evaluate the impact of high tech because it is still in the introductory phase and learning cycle.

In a study appearing in Training Magazine [4] executives from three firms competed against each other in a financial strategy game to see who would survive. An earlier study referenced by these researchers revealed that most commercial spreadsheet packages performed equally well; the differences were in how well people use them. The finding of the study was that PC's are helpful, but success still comes down to human factors, or the abilities of the people involved. Therefore,

these studies indicate that an individual's PC productivity will depend upon how competent the person is in his own field of endeavor and his abilities to use the PC software.

An article by Sharpe states that many managers quickly committed themselves to the new PC technology without fully realizing the time that was needed to learn the new programs.[4] As a result many have become frustrated, and therefore minimally use their PC's. They find it easier the "old way", by asking someone for the information rather than getting the answer themselves from the PC. Managers by nature are impatient, and become bored and frustrated if they have to wade through many menus and manuals to get the information they want. Assuming this to be true, the research team would expect this Defense Contractor study to show a statistically significant level of dissatisfaction among the respondents, especially among the older employees who developed their managerial skills and styles prior to the introduction of personal computers.

An Industrial Management Data Systems article also states that the typical senior manager is one who has been working in industry for at least 20 years.[5] The new PC technology is forcing the typical manager to acquire new skills and even to reactivate his typing skills. It is difficult for them to do this and keep up with their own job tasks.[7]

Catherine L. Harris, writing in Business Week, [8] had a more positive view of what automation has accomplished. Although the broad classification "office automation" is used, the bulk of the article addresses the impact of automation at the management level. Time management was an area mentioned as benefiting from an automated environment. Harris presented the results of a study by Dataquest, where 200 companies of 100-999 employees were studied, as were 200 companies of 1000 or more employees. In three job level categories of professional, middle-level and top-level managers, only a small percentage of respondents indicated that office systems allowed them to cut costs by at least 10 percent. However, in the areas of communications, over 35 percent of the respondents were able to cut costs by 10 percent or greater. Picking out only quantifiable factors does not allow a true evaluation of these systems at the managerial level. This brings the research team back to the purpose of evaluating "perceptions" or feelings and researchers have found that where computer owners and persons have taken computer classes they have a more positive attitude towards computer usage. [7]

Also, although Bowen[2] initially downgraded the impact of computer technology upon management, he did include the opinions of several industrialists who were more positive on the effect that computers had on management. Positive attributes repeatedly mentioned were the improvement in communications; a reduction in management levels; and the exercising of more control by fewer managers. The area of ownership and historical

use, "How long has this person used a PC?", is an aspect the research team is closely examining to determine "system appreciation."

Perhaps the study that comes closest to the situation at the selected corporation was a survey conducted of middle managers to investigate their perceptions of the impact of automated office systems on their jobs and work. A questionnaire was sent to 151 middle managers from fourteen different organizations. A response rate of 50.3% or seventy-six questionnaires were returned. The survey reported with two key findings: (1) Middle managers perceived that office automation made their jobs and work more enriching and satisfying: and (2) Middle managers with computer experience were more positive in their approaches to their work than managers without this experience.[8]

To summarize, a review of literature indicates that the issue of measuring productivity of managers PC usage is in its early stages. Thus, a justification exists for the additional study of personal computer usage among managers.

METHODOLOGY

SURVEY SAMPLE

This study was conducted at a Defense Contractor's facility in Austin Texas, during July, 1988. All managers and directors

of that company were asked to participate in a survey. The sample frame was the Managers/Directors Distribution List, supplied by the Personnel Department.

Although this group is referred to as "the sample". The group is actually a census, since all managers and directors at the Industrial-Based Defense Contractor are included on the list.

The managers on this list were asked to complete a questionnaire to determine their perceptions on the effect of personal computers on their job performance.

MATERIALS

The statistical package used for the analysis of this research was SPSSx.

DESCRIPTION OF TESTING INSTRUMENT

The testing instrument was a questionnaire. This questionnaire consisted of twenty questions designed to determine the perceptions of managers concerning the impact of personal computers on job performance.

PROCEDURES

The survey instrument was subjected to a pretest before general distribution. The pretest participants comprised four

managers from the Texas Higher Education Coordinating Board. The final questionnaire was administered through the use of the selected corporation's internal mailing system. One hundred and sixty (160) questionnaires were distributed. A total of ninety-one (91) questionnaires were returned resulting in a 56.8% response rate.

FINDINGS

This study has resulted in several important findings that are of significance to the managers and decision-makers. These findings are presented below as answers to first the specific research questions developed by the researcher, and second the management questions as identified in the introduction of this report.

RESEARCH QUESTIONS

How many managers have personal computers at work? A total of 85 of the 91 responses received, or 93.4%, indicated that they do have PC's available to them.

This demonstrates a large investment of capital and an equally large manpower commitment to computer technology by the firm.

How many managers have personal computers at home?

The survey data shows that 51.6% (47/91) of the managers that

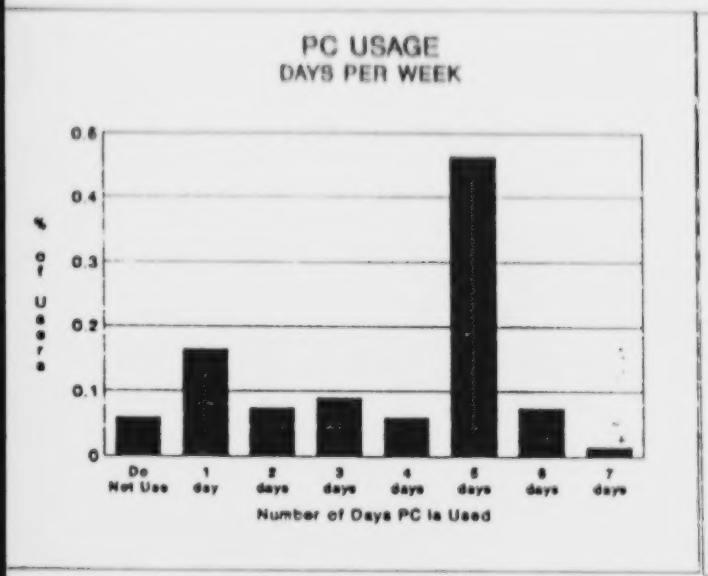
responded own a personal computer at home.

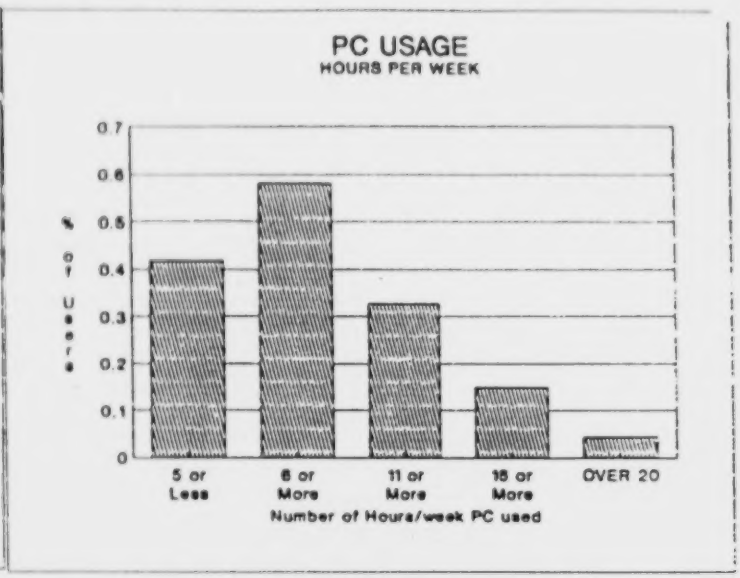
The fact that such a high number of managers have personally invested in PC's demonstrates a high level of interest in the technology.

How often do managers use personal computers?

P/C USAGE

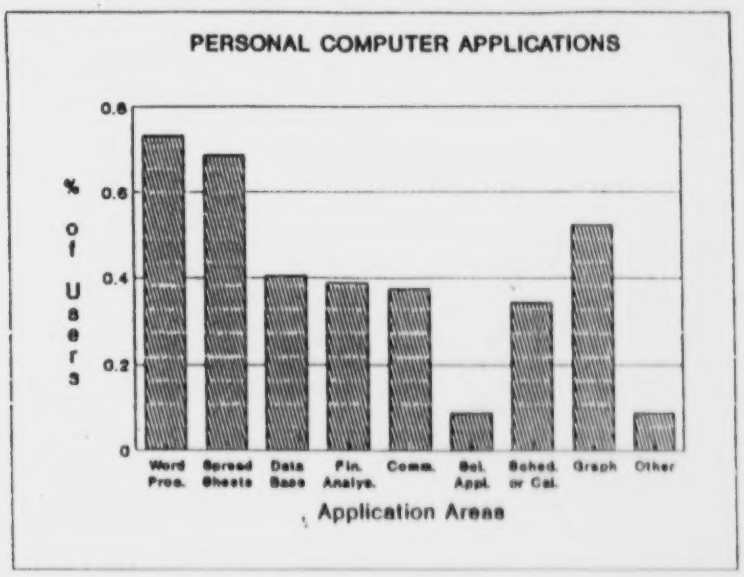
DAYS/HRS.





Forty-six percent (31/67) of the managers that use personal computers use them five days a week. On average, PC's were used 3.7 days a week. A total of 58.2% (39/67) of managers that use PC's use them more than six hours a week. By examining the use of PC's in both days and hours, it was learned that not only a significant percentage of managers use PC's on a regular basis, but they are using PC's for extended periods of time.

For what applications do managers use their Personal Computers?

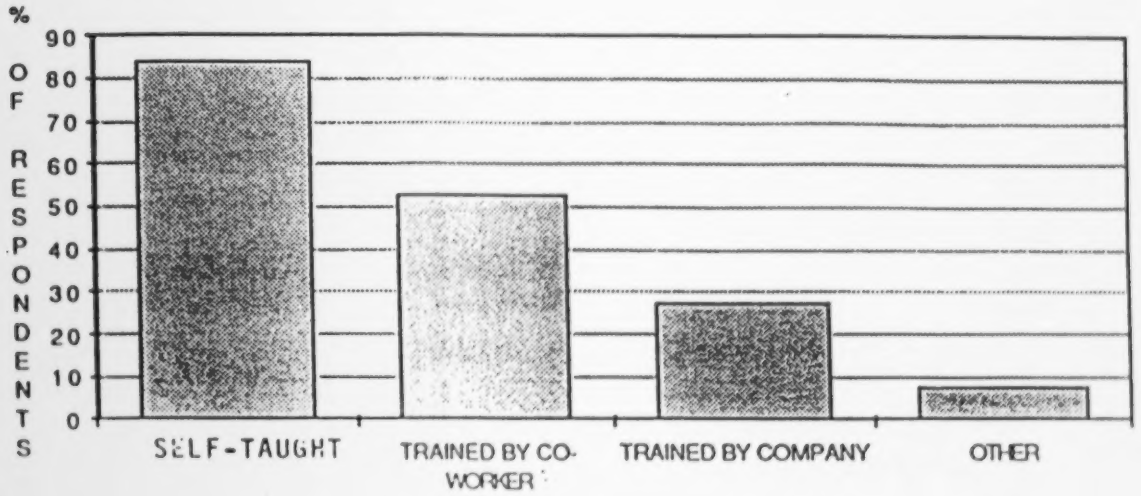


As illustrated in the graph above, the most frequent uses of personal computers are for word processing 73.1% (49/67), and spreadsheets - 69.7% (46/67).

Non-users were also asked, "If they had a PC, how would that individual use it?" Word processing, spreadsheets, and data-base applications were each selected 41.7% (10/24) of the time as the applications they would most likely utilize.

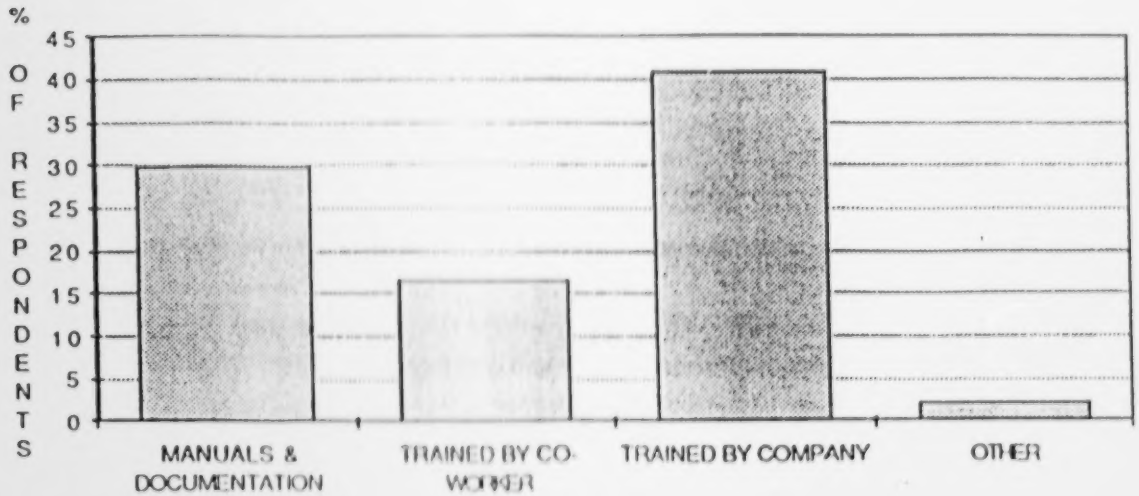
Another question asked was [5] "Are managers in technical areas more likely to use personal computers than managers in other areas?" Results show that there is no basis upon which to assume that technical managers are more likely to use PC's than non-technical managers. The survey revealed that 78.3% (18/23) of the technical managers that responded use PC's, compared to 70.0% (42/60) of the non-technical managers.

How have managers been trained to use personal computers?



A total of 84.6% (77/91) taught themselves to use their computers and applications. In addition, 51.6% (47/91) said they also received training by a co-worker. Also, 26.3% (24/91) said they received company training, which consists of two to three hour software package training sessions. Another 7.7% (7/91) said they received other unspecified types of PC training.

How would managers like to be trained in the use of the personal computer?



OTHER MANAGEMENT QUESTIONS

When asked the percentage of managers who actually use personal computers, a total of 85 of 91 managers, or 93.4% indicated that they have a PC accessible to them at work. However, 78.8% (67/85) reported actually using the PC's. The analysis shows that 55.2% (37/67) of the managers responding use their computer five or more days per week, while 57.8% (37/64) use them at least six hours per week.

When asked if they believe more tasks are accomplished using a personal computer, managers reported the following:

Table 1

ARE MORE TASKS ACCOMPLISHED USING A PERSONAL COMPUTER?

	2		1		0		-1		-2				
	GREAT INCREASE		SOME INCREASE		NO EFFECT		SOME DECREASE		GREAT DECREASE		TOTAL		
	FREQ	SCORE	FREQ	SCORE	FREQ	SCORE	FREQ	SCORE	FREQ	SCORE	SCORES	N	RATING
EFFICIENCY	37	74	24	24	5	0	0	0	1	-2	96	67	1.43
TIMELINESS	30	60	29	29	6	0	1	-1	0	0	88	66	1.33
TASK ACCOMPLISHMENT	35	70	25	25	6	0	0	0	0	0	100	66	1.52
TIME FOR OTHER TASKS	24	48	23	23	16	0	0	0	1	-2	69	64	1.08
CONFIDENCE IN WORK	28	56	16	16	17	0	2	-2	0	0	70	63	1.11
ACCURACY	39	78	17	17	10	0	1	-1	0	0	94	67	1.40

In order to derive an overall ranking of task accomplishment, values were assigned to each of the possible responses. (Values ranged from (+2) Great Increase, to (O) No Effect, to (-2).

Next, the value of each response was multiplied by the frequency of that response. Finally, the response scores were added to form a cumulative total score, which then divided by the number of respondents to the question(N). This process yielded an overall rating of 1.52. This rating reflects a significant increase in task accomplishment as perceived by the computer users.

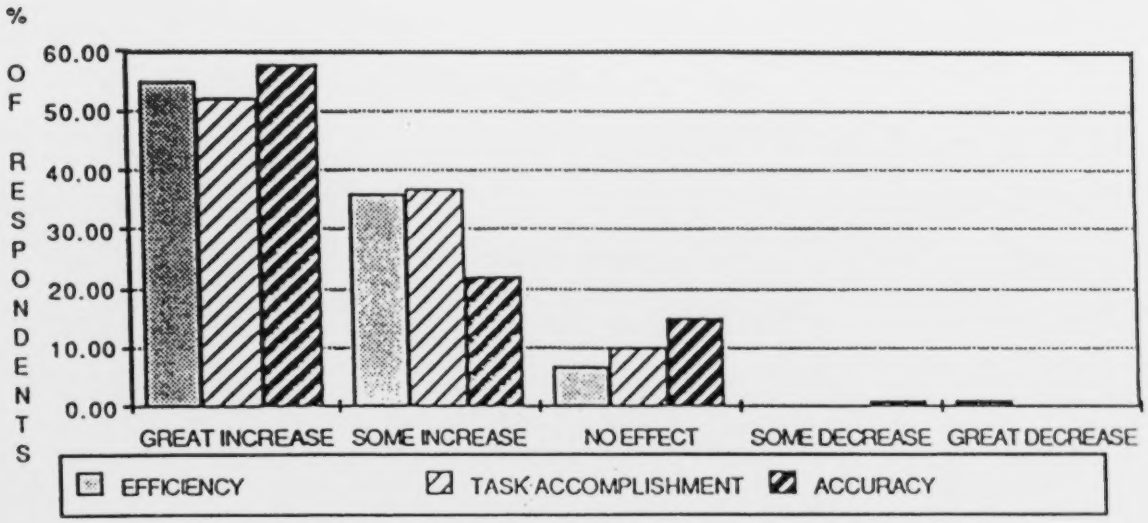
Managers were asked how important Pc's were to them in performance of their work. The results of this question are presented in Table 2 below.

TABLE 2
IMPORTANCE OF PC'S TO MANAGER'S WORK

	2		1		0		-1		-2				
	VERY IMPORTANT		IMPORTANT		NO EFFECT		NOT IMPORTANT		EXTREMLY NOT IMPORTANT		TOTAL		
	FREQ	SCORE	FREQ	SCORE	FREQ	SCORE	FREQ	SCORE	FREQ	SCORE	SCORES	N	RATING
IMPORTANCE OF A P.C. TO YOUR WORK	35	70	26	26	3	0	1	-1	1	-2	93	66	1.41

In examing the additional statistical data, we cross tabulated several variables to explore possible relationships. We were able to correlate PC usage at a confidence level of .93.

In this instance the Pearson's R of .18506 indicates a positive correlation but not very strong.



To examine further relationships with age, we correlated age categories with their effect on task accomplishments. The statistical results of this analysis turned out very interesting.

The level of significance was low at .507 therefore it seems that contrary to many opinions, older managers are using PC's in increased numbers. In addition the effect of PC's across all age categories on task accomplishment is insignificant. The age of the PC user is statistically insignificant across the study.

Although the selected corporation is an engineering firm, non-technical support personal comprised a majority of the respondents.

When correlating the effect on task accomplishment and department type (engineering vs. non-engineering) the level of

significance is .767 which indicates there is no significant relationship between engineer's and support personnel at the .93 confidence level. When examining the responses of each department type it was noted that 94.5% (17/18) of the engineers and 88.6% (39/44) of support personnel felt that PC's increased their effect on task accomplishment.

A Pearson's R value = .047 indicates a positive relationship in the correlation under examination although not a strong one. This analysis can be of use to management because of the implication that PC's can benefit all managers in all divisions, not just engineering.

CONCLUSIONS

Results show the personal computer to be a valuable managerial tool. Only 2 out of 91 respondents indicated a negative bias to personal computers. The selected corporation appears to be garnering a good return on its PC investment in light of the enthusiastic attitude of its managers. The positive acceptance of PC's and the utilization rates exhibited a moderate amount of dependency upon PC's in certain areas. This dependency has a much more positive implication than negative. The fact that managers feel they can perform better in both the quality and quantity of their jobs, lead the researchers to conclude that it is to the corporations advantage to continue to support the introduction of PC's, software and associated training into the work environment.

RECOMMENDATIONS

The research and findings of this study support the following recommendations for the selected corporation:

The use of PC's should be encouraged at all management levels.

Survey results indicate strong managerial support for the use of personal computers and their applications. Even in the non-engineering or non-technical areas, respondents in the 40-50 age group, who probably developed their managerial skills in a non-PC environment, are some of the main proponents for PC's.

The current incentive program at the selected firm is to subsidize the purchase of PC's by employees by refunding 15% of the sale price of the PC after six months from the date of purchase. This should be continued.

This study reveals that those managers/directors that own PC's are much more receptive to their capabilities. It is recommended that the Corporation promote the employee purchase plan further and/or increase the incentive to purchase PC's by offering no interest/low interest loans.

Although many of the PC's purchased through this program are used at home, there is a positive correlation between PC own-

ership and the increased perceptions by managers of the positive impacts that personal computers have on their work. Self-training at home can be a significant factor in the efficient use of personal computers in the work environment.

Since 40.6% of respondents expressed a desire for company training on personal computers, the researchers recommend that the selected corporation consider implementing an in-house training program.

And finally, another study of this type needs to be made including more than one type of company. In addition the survey instrument should include some additional questions as well as some deletions. This study could provide a good base for such additional research.

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